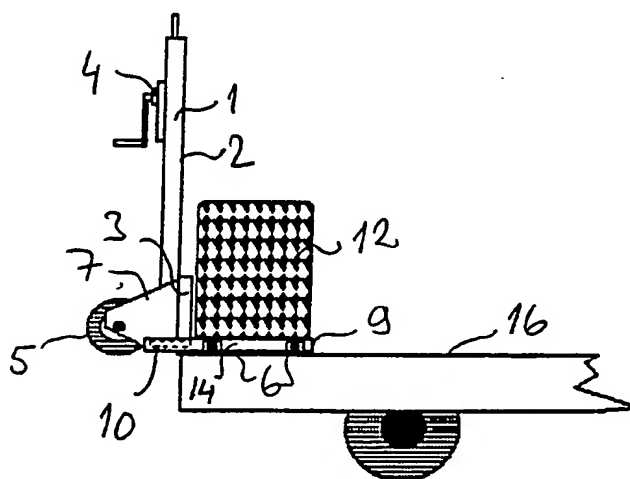




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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|--|--|----|--|
| (51) International Patent Classification <sup>5</sup> :<br><b>B62B 1/08, B66F 9/06</b>   |  | A1 | (11) International Publication Number: <b>WO 92/07746</b>  |
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(54) Title: SELF ELEVATING FORKLIFT TRUCK



## (57) Abstract

A lifting device (1) for moving of a load (12) on one plane, changing of the moving plane and continuation of the moving on the second plane. The lifting device (19) comprises a body (2), a thereto supported, as to its vertical position by means of a lifting mechanism (4) guided sliding carrier (3) with forks (14), optional moving wheels (5), wheeled supporting arms (9), which while moving from one plane onto another can, guided by a slide element (10) connected to the body (2), be pulled substantially to the side of the body (2) that is opposite the load (12).

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#### + DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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## SELF ELEVATING FORKLIFT TRUCK.

The present invention relates to a wheeled lifting device and a method applicable in its use. By means of the device it is possible to load and unload e.g. vehicles. The device is also fit for ascending and descending stairs with a load.

Striving for minimization of storages for example in enterprises has increased the number of deliveries and consequently the volume of delivery traffic in the enterprise sector. As various heavier household appliances have become more common and rapid development has reduced their lifespan, the delivery traffic between households and shops has grown.

It is no longer common to have a so-called helper in support of the driver even in heavier delivery vans. Vehicles are usually provided with different tail lifts which enable the lowering of the transportable load from the platform down onto ground level. The moving of the load on the platform from the loading space to the tail lift is carried out by means of different fork lift trucks or other known facilities. With the aid of these it is also possible to move the load also on ground level in the vicinity of the vehicle. The problematic points in the delivery of goods are constituted by even small numbers of stairs, located e.g. between the immediate surroundings of the delivery van and the goods lift of an office building or similar. One single stair makes the use of a known hand pallet truck impossible. As the driver of the delivery van often works alone when delivering goods, even a light delivery van must be provided with a tail lift or similar to allow loading and unloading. Even light tail lifts are relatively expensive and cost in Finland about FIM 20,000, mounting included. In small delivery vans the said stationary lifting devices also take substantially room inside the vehicle. Besides the tail lifts, the vehicles must also be provided with other means for moving the load both in and outside the vehicle. Through e.g. patent documents US 4,061,237 and PCT/US83/00858 have previously become known motor driven fork lift trucks which

are capable of ascending to the loading space of a vehicle. With one pair of wheels equipped two-body lifting devices utilizing a screw driven by electric motor have also become known, which lifting devices allow the moving of the load as  
5 desired on the platform of the vehicle and lowering it onto the ground. By the said lifting devices it is also possible to ascend stairs.

The devices described above in the US patent specifications  
10 are expensive and very complicated as regards their functioning. They can be considered for use in lighter delivery vans. A lifting device utilizing a rotating screw and provided with one pair of wheels is fit for the use referred to but only with light loads. Loads exceeding 100 kg  
15 by weight absolutely call for two persons for manoeuvring the controls, and as told above, this is often impossible in the use dealt with here.

Through the device and method according to the invention it  
20 is possible to substantially remedy the drawbacks described above. To realize this, it is characteristic of the device according to the invention what has been disclosed in the characterizing part of claim 1. As the greatest advantage provided by the invention can be regarded the fact that it  
25 makes it possible to move the load in the loading space of the vehicle, lower it from the vehicle onto ground level, and move it on ground level, even in stairs connected to it, by means of a device that is safe to use and has low manufacturing costs. Tail lifts or similar, having to be  
30 mounted stationary in the vehicle, may be abandoned and no other accompanying moving devices are needed.

In the following the invention is described in detail with reference to the attached drawing.

35 Fig. 1 shows a side view of the device according to the invention.

Fig. 2 shows a front view of the same as fig. 1.

Fig. 3 shows a side view of the device according to the invention, but with the load lowered down in the loading

space of the vehicle.

Fig. 4 shows the same as fig. 3 but with the supporting wheels used in planar moving moved into a lifting position.

Fig. 5 shows the same as Fig. 4 but with the wheels lifted  
5 onto the plane of the platform.

Fig. 6 shows the same as fig. 5 but with the supporting wheels again moved into the position used in planar moving.

Fig. 7 shows a side view of the device according to the invention in the stage of planar moving on the platform of  
10 the vehicle.

Fig. 8 shows in detail how the supporting arm of the lifting device according to the invention is attached to the body.

As shown in Fig. 1 and 2 the lifting device 1 according to  
15 the invention comprises a body 2 of appropriate construction, a thereto attached and in respect thereto vertically, in a controlled manner moving slide 3, further to the body 2 through an axle 8 and a supporting construction 7 possibly attached wheels 5 and supporting arms 9 provided with wheels  
20 6 which can be locked into their position, which arms are allowed to move, guided by a slide 10, substantially perpendicularly with respect to the plane of the body 2. The body 2 is preferably manufactured of appropriate steel profiles and plate elements by welding. A fork-model sliding  
25 carrier 3, preferably of steel construction, is in an in itself known manner, e.g. through rolls, coupled to be movable, supporting itself to the profile shape of stanchions 11 of the body 2. The height of forks 14, which support a load 12, of the sliding carrier 3 slightly exceeds the  
30 constructional height of supporting arms 9 provided with wheels 6. The wheels 5 and 6 rest on the base preferably in the same plane, parallel to the plane formed by the supporting arms 9. The lower surface of the wheels 5, 6 lies appropriately below the other constructional elements of the  
35 device according to the invention. Of the wheels 6, which in an in itself known manner have been fixed into connection with the supporting arms and of which there preferably are at least two pairs as shown in the Figures, one or alternatively both pairs are of the free-rotating type. If the lifting

device 1 according to the invention is also provided with larger wheels 5, to be borne by which the lifting device 1 with the load 12 may in a known manner be tipped during the moving, both wheel pairs 6 are of the free-rotating type. If  
5 the wheels 5 have been realized as free-rotating or steerable, the other wheel pair 6 need not be free-rotating or steerable. The wheels 6 are placed in the supporting arms 9 in such a way that in the projected position as shown in Fig. 1 of the supporting arm 9 they are located substantially  
10 underneath the load 12 and in the position where the arm has been pulled back as shown in Fig. 5 substantially behind the sliding carrier 3.

The lifting mechanism 4 of the lifting device may be a  
15 transmission mechanism utilizing an in itself known screw, a chain gearing, hydraulics, pneumatics etc., by which the vertical position of the sliding carrier 3 with respect to the body 2 is guidedly adjusted either at a shaft 13 by using muscular work, by means of an electric motor through push-  
20 button control or in some other way. The said guiding results in that while the wheels 5,6 of the lifting device 1 are in touch with the base, it is possible by means of the lifting mechanism 4 to freely adjust the vertical position of the sliding carrier 3 and the load 12 on it in respect to the  
25 body 2, within the limits set by the construction. Likewise, when the sliding carrier 3 again is supported e.g. to the platform of the vehicle, Fig. 3, 4 and 5, the position of the body 2 in respect to the sliding carrier 3 can be adjusted by the lifting mechanism 4.

30 Fig. 8 presents a solution for a preferable guiding principle of the supporting arm 9 in the direction permitted to its movement. The slide element 10 comprises more than one sequentially installed bearings 15 which have been fixed to the body construction 7, 11 in a known way. The supporting  
35 arm 9 is formed of an appropriate profile, e.g. a C-profile, which at its inner surface bears against bearings 15. The slide element 10 may also be made of into a functional form cut steel bar or profile which is provided with plates promoting the sliding of the supporting arm 9 or

alternatively with lubrication. The position of the supporting arm 9 in respect to the body construction 7,11 is adjusted for example by muscular force and the supporting arm can be locked into this position for example by using in  
5 itself known pin locking systems or similar. The position of the supporting arm 9 may also be adjusted by different known lever-spring-return constructions, which can be arranged to be controlled at the upper part of the lifting device 1 by in itself known remote-control devices.

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In the following there is described the use in the loading of a vehicle of the lifting device 1 according to the invention:  
- in accordance with Fig. 1 and 2, the lifting device is loaded in a known manner with a load 12 which may be for  
15 example a payload on a truck pallet or similar, or a mere truck pallet etc.,

- the lifting device 1 is pushed by muscular force, or, if it is provided for example with an electric motor and batteries, guided mechanically to the proximity of the platform 16;  
20 during the moving the free-rotating wheels 6 seek their direction guided by the moving force, if the lifting device is provided with wheels 5 and the weight of the load 12 allows it, the moving can also be carried out by tipping the lifting device 1 appropriately into the side opposite the  
25 load 12 in such a manner that the weight of the lifting device 1 and the load 12 substantially rests on the wheels 5 and the supporting arms 9 with wheels 6 do not bear against the base.

- by the lifting mechanism 4 the sliding carrier 3 with the  
30 forks 14 and the load 12 is guidedly adjusted at such a height above the base that the lifting device 1 can be pushed into the position shown in Fig. 3, whereby the sliding carrier 3 and the load 12 substantially rest on the platform 16, the supporting arms 9 with wheels 6 bear against the base  
35 and are hereby guided beneath the platform 16

- by adjusting the lifting mechanism 4 the sliding carrier 3 with the load 12 is lowered to be borne by the platform 16

- the lockings of the supporting arms 9 are released and the lifting arms 9 with the wheels 6 are pulled into the position

shown in Fig. 4 in which they are substantially located on the side of the body 2 that is opposite the sliding carrier 3; the supporting arms 9 may also be provided with an in itself known locking into this position, however, this is not  
5 a necessity, because they are not under stress in this position

- by adjusting the the lifting mechanism 4 appropriately and with the sliding carrier 3 with the load 12 being supported onto the platform 16, the body construction of the lifting  
10 device is lifted into such a height in respect to the carrier 3 that the supporting arms 9 with the wheels 6 can be pushed past the forks 14 underneath the load 12 and locked into their position; at the lifting stage, if the supporting arms 9 are not provided with a locking into the rear position,  
15 special care shall be taken to prevent the chance that they during the lifting operation move underneath or against the platform 15 and thus are damaged

- the sliding carrier 3 with the load 12 is by adjusting the lifting mechanism 4 lifted slightly upwards on the plane of  
20 the platform 16 and the load 12 is by the lifting device 1 moved to a desired location on the platform 16

- the load 12 is in a known manner lowered onto the plane of the platform 16 and the lifting device is pulled out from underneath the load 12

25 - a loaded or unloaded lifting device 1 according to the invention is removed from the platform 16 by taking the above steps in a reverse order.

The sliding carrier 3 may, besides the above described forks  
30 14, also be provided with a variety of other known devices facilitating the pulling on and pushing out of the load 12, e.g. a roll-table or similar. The construction of the sliding carrier 3 of the lifting device 1 according to the invention and the positions of the supporting arms 9 with respect  
35 thereto have preferably been selected so as to allow the handling of standard pallets. The wheels 5 or one pair of wheels 6 of the lifting device 1 may be provided with an in itself known transmission using either the same power source with the lifting mechanism 4 or a separate one. The lifting



device 1 provided with driving wheels in the manner described above enables the moving of heavier loads 12 also on slanting bases. The ends opposite the sliding carrier 3 of the forks 14 may be provided with a counterweight to balance a tipping force that may appear in planar moving of an unloaded lifting device 1 with the supporting arms 9 pulled into a rear position. The wheels of the lifting device according to the invention may also be selected so that both pairs of wheels 6 are stationary but that the location of the wheels 6 which are closer to the body construction 7, 11 is slightly above the plane formed by the other wheels 6 and the wheels 5. The wheels 5 are in this case free-rotating. Thus e.g. when the lifting device 1 is being pushed onto the platform 16 of the vehicle, the wheels 6 first bear against the plane of the platform and a minor lifting work must be done to lift the wheels 5 onto the platform 16. If the measurements have been selected appropriately, this will not cause any major trouble or stress.

The lifting device according to the invention may replace a tail lift mounted on a vehicle and it can be used for the handling of a variety of loads, e.g. those intended to be transported by means of so-called hand pallet trucks both outside the vehicle and in the platform space. Besides for loading vehicles, the lifting device can also be used in other forms of load transport and handling, particularly advantageously in cases involving changing of travelling plane that cannot be carried out travelling on wheels. The lifting device may also be provided with a battery driven electric motor which operates a lifting screw by means of a push-button control or similar. If the lifting device is carried with the vehicle, the charging of the batteries can be arranged to take place during the transport by using the dynamo of the vehicle. In this case the lifting device replaces the hand pallet truck and the stationary tail lift. In any case it is to be understood that the invention has above been explained with reference to a few preferable embodiments only, however, not desiring in any way to restrict the invention to these exemplary embodiments only, several modifications being possible within the scope of the

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inventive idea as defined by the patent claims now following.

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## CLAIMS

1. A lifting device (1) for moving of an on a pallet lying or other load (12) outside a loading space (16) of a vehicle, lifting it onto the loading space (16) of the vehicle and moving it in the said loading space (16), or for handling of load in other surroundings where the changing of the moving plane constitutes a substantial part of the moving operation, in which changing of the plane the load is lifted to a desired height substantially at right angles to the first base of moving, with moving wheels (5) and wheeled supporting arms (6,9) of the lifting device resting on the said base of moving on the load (12) carrying side of the body (2) and that during the plane changing operation the guided and load (12) bearing constructional elements (3, 14) of the lifting device (1) bear on the second moving plane (16) for lifting to an appropriate height of the body (2) and the moving mechanism (5,6,9) in its lower part by means of a lifting mechanism (4), during which lifting operation said moving mechanism is located substantially on the side of the body (2) that is opposite the load (12) and after which stage the wheeled supporting arms (6,9) are pushed underneath the load (12) whereupon the load (12) is lifted to the height of the second moving plane to be moved as desired, characterized in that the moving mechanism (5,6,9) of the lifting device (1) comprises on three axle lines installed wheels (5,6) of which always the wheels of two axle lines rest on the base.

2. A lifting device (1) according to claim 1, characterized in that the ends of the lifting forks (14) are provided with a counterweight.

3. A lifting device (1) according to claim 1 or 2, characterized in that the lifting device (1) on the side of the body opposite the load (12) comprises wheels (5) to be substantially borne by which during planar moving the lifting device (1) with the load (12) is brought by tipping the lifting device (1) so that the supporting arms (9) with the wheels (6) get clear of the transport plane.

4. A lifting device (1) according to claim 1, characterized  
in that the pairs of wheels (6) of the supporting arms (9)  
are direction-bound and the wheels (5) connected to the body  
5 construction (7,11) are free-rotating.

5. A lifting device (1) according to claim 3, characterized  
in that all pairs of wheels (6) of the supporting arms (9)  
are free-rotating.

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6. A method for moving load by means of the lifting device  
(1), which moving involves a substantial change of the  
vertical travelling plane, characterized in that  
in the first stage, when the wheels (5) of the body (2) of  
15 the lifting device (1) on the side of the body (2) that is  
opposite the forks (14) and the from the body seen  
farthermost wheels (6) of the supporting arms (9) rest on the  
first moving base, the load is loaded in a known manner to be  
borne by the as to the vertical position guided  
20 constructional elements (3,14) of the lifting device (1), the  
wheeled supporting arms (9) being substantially parallel to  
the constructional elements (3,14) and located on the same  
side of the body (2) of the lifting device (1), and that  
in the second stage the load (12) is by the lifting mechanism  
25 (4) of the lifting device (1) guidedly lifted onto an  
appropriate moving plane and moved as desired, and that  
in the third stage the load (12) is guidedly lowered onto the  
second moving plane (16) so that the guided constructional  
elements (3,14) of the lifting device (1) bear against the  
30 said second moving plane (16) and the wheeled supporting arms  
(9) rise somewhat above the moving base whereupon the wheeled  
supporting arms (9) are unlocked from their position and the  
supporting arms (9) are pulled substantially parallel with  
the second moving plane to the side of the body (2) of the  
35 lifting device (1) opposite the load (12), and that  
in the fourth stage the with the supporting arms provided  
lower part of the body (2) of the lifting device (1) is  
guidedly, with the constructional elements (3,14) resting on  
the second moving plane (16), lifted to such a height from

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the first moving plane that the wheeled supporting arms (9) can be pushed underneath the load (12) to their original position with respect to the load (12) and the body (2), in which case the wheels (6) of the both axle lines of the supporting arm (9) bear against the second moving base (16), and that

in the fifth stage, when the load (12) has been lifted slightly above the second moving plane (16), the lifting device (1) is in its entirety pushed onto the second moving plane (16), the lifting device (1) being then again borne by the same wheels as in the starting situation, whereupon the lifting device (1) can be moved as desired on the second moving plane (16).

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## AMENDED CLAIMS

[received by the International Bureau on 11 November 1991 (11.11.91);  
original claims 1 - 6 replaced by amended claims 1 - 5 (2 pages)]

1. A lifting device (1) for moving of an on a pallet lying or other load (12) on  
a first plane, lifting it onto a second plane (16) and moving it on this plane  
5 (16), in which plane changing operation the load is lifted to a desired height  
substantially at right angles to the first plane with the lifting device (1) resting  
with its wheels (5, 6) on said plane and which lifting device (1) during the  
plane changing operation rests only with its load carrying constructional  
elements (3, 14) on the second plane (16) for lifting to an appropriate height of  
10 a body (2) and a moving mechanism (5, 6, 9) included in its lower part by  
means of a lifting mechanism (4) during which lifting operation wheeled  
supporting arms (6, 9) included in said moving mechanism (5, 6, 9) are  
entirely withdrawn from beneath the load (12) and after which lifting  
operation said supporting arms (6, 9) are pushed underneath the load (12) to  
15 their initial position whereupon the load (12) is lifted up to the height of the  
second moving plane to be moved as desired and in which lifting device (1) the  
moving mechanism (5, 6, 9) comprises wheels (5, 6) placed on at least three  
axial lines, characterized in that the wheels (5) on one of the axial lines are  
mounted stationarily in the body (2) of the lifting device (1) on the side  
20 opposite to the load (12) and that the wheels (6) of at least two axial lines  
placed in an in itself known manner in the movable supporting arms (9), either  
all or with the exception of the wheels on one of the axial lines, are free-  
rotating and that in the other 'free-rotating/direction-bound' combinations of  
the wheels (5, 6) the other wheels (6) mounted in the supporting arms (9) are  
25 placed appropriately above the plane determined by the lower surfaces of the  
wheels (5) located in the back of the body (2) and of the wheels (6) located in  
the extreme end of the supporting arms (9).

2. A lifting device (1) according to claim 1, characterized in that the ends of  
30 the lifting forks (14) are provided with a counterweight which balances the  
force seeking to overturn the unloaded lifting device (1) backwards while the  
body is being lifted.

3. A lifting device (1) according to claim 1 or 2, characterized in that the stationary wheels (5) of the body (2) of the lifting device (1) have a bound direction of rotation.

5 4. A lifting device (1) according to claim 3, characterized in that the lifting device (1) with the load (12) is during planar moving borne merely by the stationary wheels (5) of the body (2) having a bound direction of rotation.

5. A method for moving a load by means of a lifting device (1) in which  
10 method a change of the moving plane is an essential part of the moving operation, in which operation the lifting of the load (12) to a desired height is carried out substantially at right angles to the first plane with the lifting device (1) resting only with its load carrying constructional elements (3, 14) on the second plane (16) during the plane changing operation for lifting to an  
15 appropriate height of a body (2) and a moving mechanism (5, 6, 9) included in its lower part by means of a lifting mechanism during which lifting operation the wheeled supporting arms (6, 9) included in said moving mechanism (5, 6, 9) lie in their entirety withdrawn from beneath the load (12) and after which lifting operation said supporting arms (6, 9) are pushed underneath the  
20 load (12) to their initial position whereupon the load (12) is lifted up to the height of the second moving plane to be fully moved onto the second moving plane (16) and in which lifting device (1) the moving mechanism (5, 6, 9) comprises wheels (5, 6) mounted on at least three axial lines, characterized in that after the rise to the second plane (16) only the wheels (6) of the supporting  
25 arms (9) rest on the second plane (16) in the initial moving stage while the body (2) and the thereto attached wheels (5) stand in the air above the first and outside the second plane (16) and that in the second stage the lifting device (1) is by means of the wheels (6) of the supporting arms (9) moved appropriately forwardly on the plane (16) whereby also the wheels (5) of the body (2) are  
30 moved so as to rest on the second moving plane (16) and the lifting device (1) with the load (12) will in its entirety be borne by the stationary moving mechanism (5, 6, 9) to be moved as desired on the second plane (16).

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FIG. 1

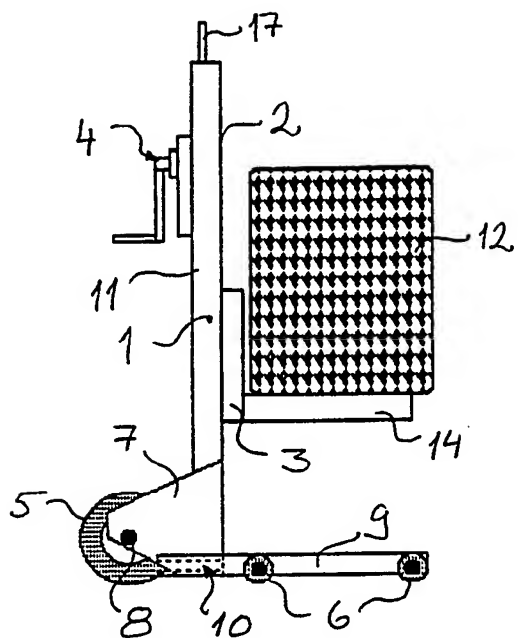


FIG. 2

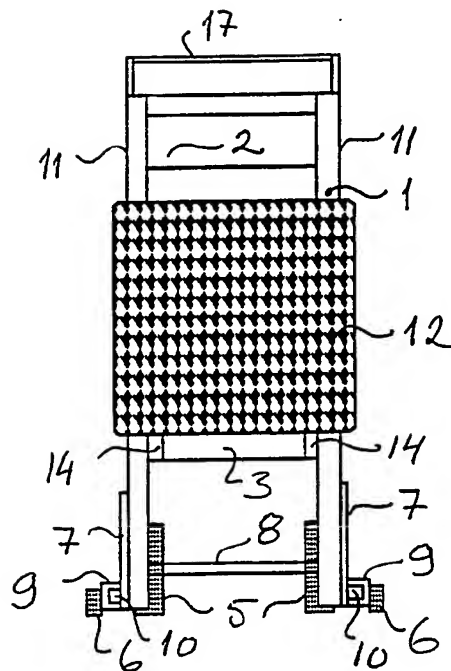


FIG. 8

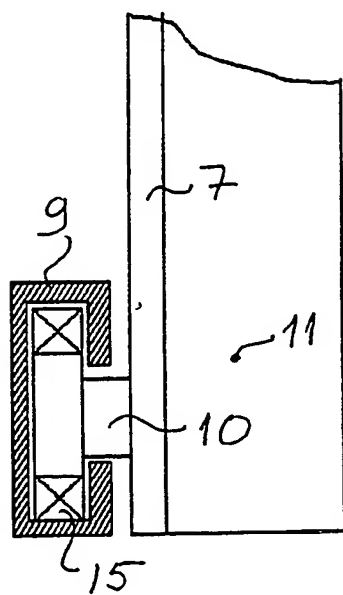


FIG. 7

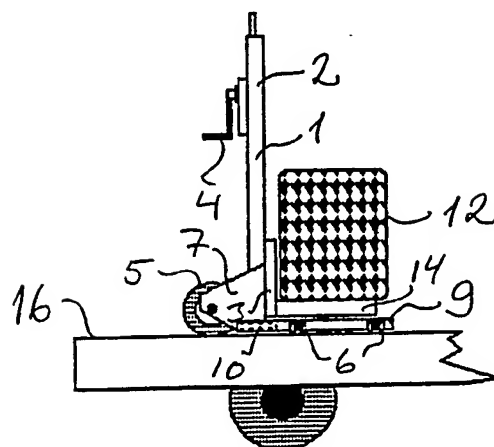




FIG. 3

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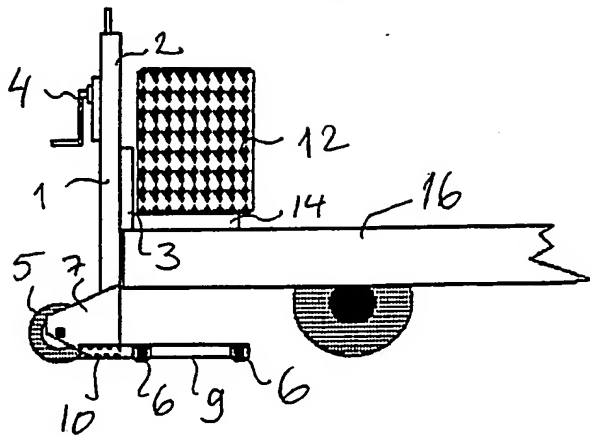


FIG. 4

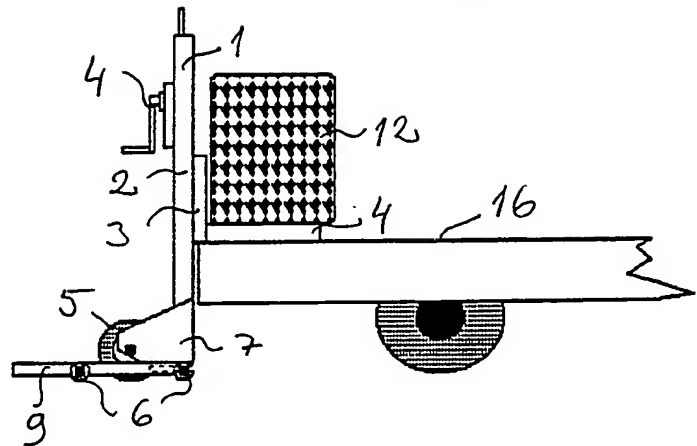


FIG. 5

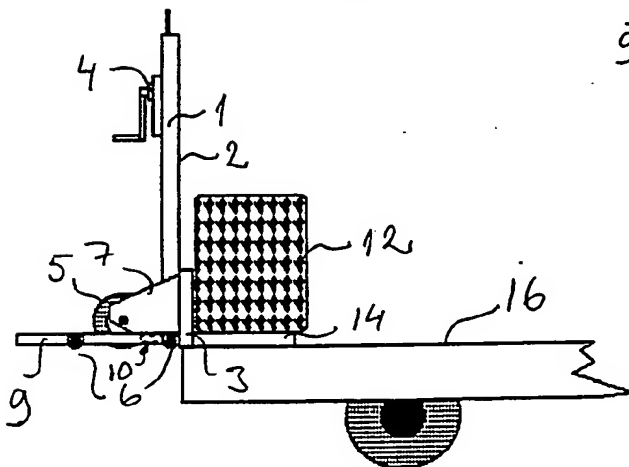
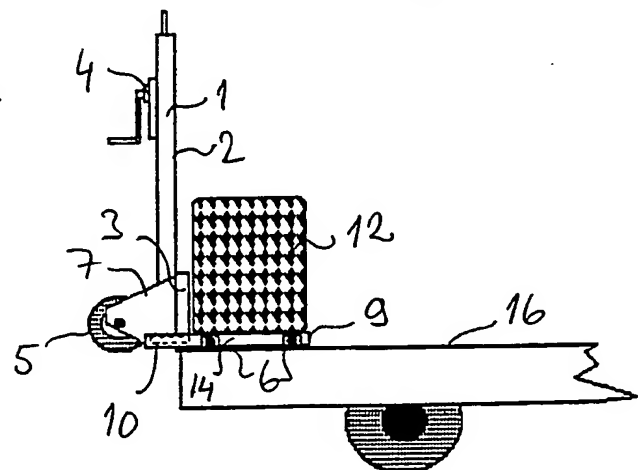
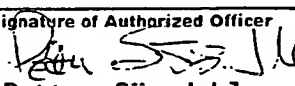


FIG. 6



# INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 91/00206

|   |   |                                     |
|---|---|-------------------------------------|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>   |   |                                     |
| According to International Patent Classification (IPC) or to both National Classification and IPC   |   |                                     |
| IPC5: B 62 B 1/08, B 66 F 9/06  |   |                                     |
| <b>II. FIELDS SEARCHED</b>  |   |                                     |
| Minimum Documentation Searched <sup>7</sup>   |   |                                     |
| Classification System   | Classification Symbols  |                                     |
| IPC5  | B 60 P; B 62 B; B 66 F  |                                     |
| Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched <sup>8</sup>  |   |                                     |
| SE,DK,FI,NO classes as above  |   |                                     |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>   |   |                                     |
| Category *  | Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>          | Relevant to Claim No. <sup>13</sup> |
| Y   | DE, A1, 2530634 (MACHINERY AND LIFTS ESTABLISHMENT) 20 January 1977, see page 5, line 15 - page 7, line 7; figures 6-10 | 1,4                                 |
| A   | --  | 6                                   |
| Y   | US, A, 4061237 (AUSTIN ET AL.) 6 December 1977, see column 8, line 26 - column 11, line 35; figures 1-8                 | 1,4                                 |
| A   | --  | 6                                   |
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| <p>* Special categories of cited documents:<sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> |   |                                     |
| <b>IV. CERTIFICATION</b>  |   |                                     |
| Date of the Actual Completion of the International Search   | Date of Mailing of this International Search Report   |                                     |
| 7th October 1991  | 1991 -10- 1 0   |                                     |
| International Searching Authority   | Signature of Authorized Officer   |                                     |
| SWEDISH PATENT OFFICE   | <br>Petter Sörsdahl                 |                                     |

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| III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET) |   |                      |
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on **91-08-30**.  
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